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ABSTRACT

While most microeconomics curriculums contain no reference to the use of microcomputers, spreadsheet packages adapt well to microeconomics courses. This presentation examines the following topics in the context of a microeconomics course: (1) The Microcomputer Spreadsheet Package--LOTUS; (2) The Spreadsheet Anatomy--cells, commands, menus; (3) Vital Keystroking; (4) Keyboard Commands; (5) Microeconomic Spreadsheet--the Pure Competition microeconomic model; (6) Using Graphs--line, bar, pie, stacked bar, and XY graphs; (7) Microeconomic Graphics; (8) Other Graphs; (9) Sensitivity Analysis--what happens if a data change is made; (10) Other Options--aesthetics; printing, protection, and database; (11) System Configuration; and (12) The Past and The Future Classroom/Office?--teaching valuable graphic skills necessary for effective communication. Illustrations highlight the information presented. (Contains 10 references.) (ALF)

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MICROECONOMICS WITH MICROCOMPUTERS

GRAPHING THE AH-HA

A WORKSHOP FOR THE
INTERNATIONAL CONFERENCE ON TEACHING EXCELLENCE
AUSTIN, TEXAS
MAY 24, 1992

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

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WELCOME, this afternoon. This presentation results from an article published in Florida Educational Computing Quarterly, Fall 1990. A jacket pocket in the back of your packet holds a copy of the article & diskette with 2 spreadsheets and concomitant graphs shown today.

Most microeconomic curriculum contain no reference to the use of microcomputers. However, most micorcomputer spreadsheet packages adapt well to microeoconomics courses.

HENCE,

MICROECONOMICS
WITH
MICROCOMPUTERS
GRAPHING THE AH-HA

If a picture is worth a thousand words, then the value of this workshop exceeds it cost. This presentation

=describes a spreadsheet,

==takes you through the specific keystrokes of using a spreadsheet,

=explores the technique of graphing copious amounts of data,

==develops the graphic illustrations of 2 microeconomic markets,

==helps you integrate microcomputers into your microecon lessons.

MICROECONOMICS WITH MICROCOMPUTERS

Today, we'll examine the following relevant topics:

1. THE MICROCOMPUTER SPREADSHEET PACKAGE.
2. THE SPREADSHEET ANATOMY.
3. VITAL KEYSTROKING.
4. KEYBOARD COMMANDS.
5. MICROECONOMIC SPREADSHEET.
6. USING GRAPHS.
7. MICROECONOMIC GRAPHICS.
8. OTHER GRAPHS.
9. SENSITIVITY ANALYSIS.
10. OTHER OPTIONS.
11. SYSTEM CONFIGURATION.
12. THE PAST & THE FUTURE CLASSROOM/OFFICE?

THE MICROCOMPUTER SPREADSHEET PACKAGE

LOTUS and other spreadsheet packages (e.g., Quatrro & Microsoft EXCEL) were designed primarily to keep track of numbers. However, LOTUS has 3-D spreadsheets, database management, graphics with an add-on, and desktop publishing capability (Bolocan, 1991).

LOTUS, as a spreadsheet, can:

* STORE & RETRIEVE DATA
(*numeric/alpha/both*)

* ARRANGE DATA IN COLUMNS & ROWS

* MANIPULATE DATA
(*COPY/MOVE/SORT/MERGE/MATRICES/LINEAR REGRESSION*)

* MAKE ARITHMETIC CALCULATIONS &

* EXECUTE MATH FUNCTIONS

* DISPLAY CONTIGUOUSLY GRAPHS & DATA TABLES
W/ ALLWAYS ADD-ON PRINTING

* ENGAGE IN SENSITIVITY ANALYSIS
(What-if?)

* PERFORM MACRO PROGRAMMING COMMANDS

* MORE (e.g., database, graphics, WYSIWYG, etc.)

THE SPREADSHEET ANATOMY

* **CELLULAR GRID** The monitor screen only reveals a small part of the worksheet. Cell addresses range cell A1 (i.e. column A, row 1) to >IV 286. Columns are customarily 9 characters wide, but you can extend the column width to contain 512 characters in one cell (i.e., six [6] times the width of the screen!).

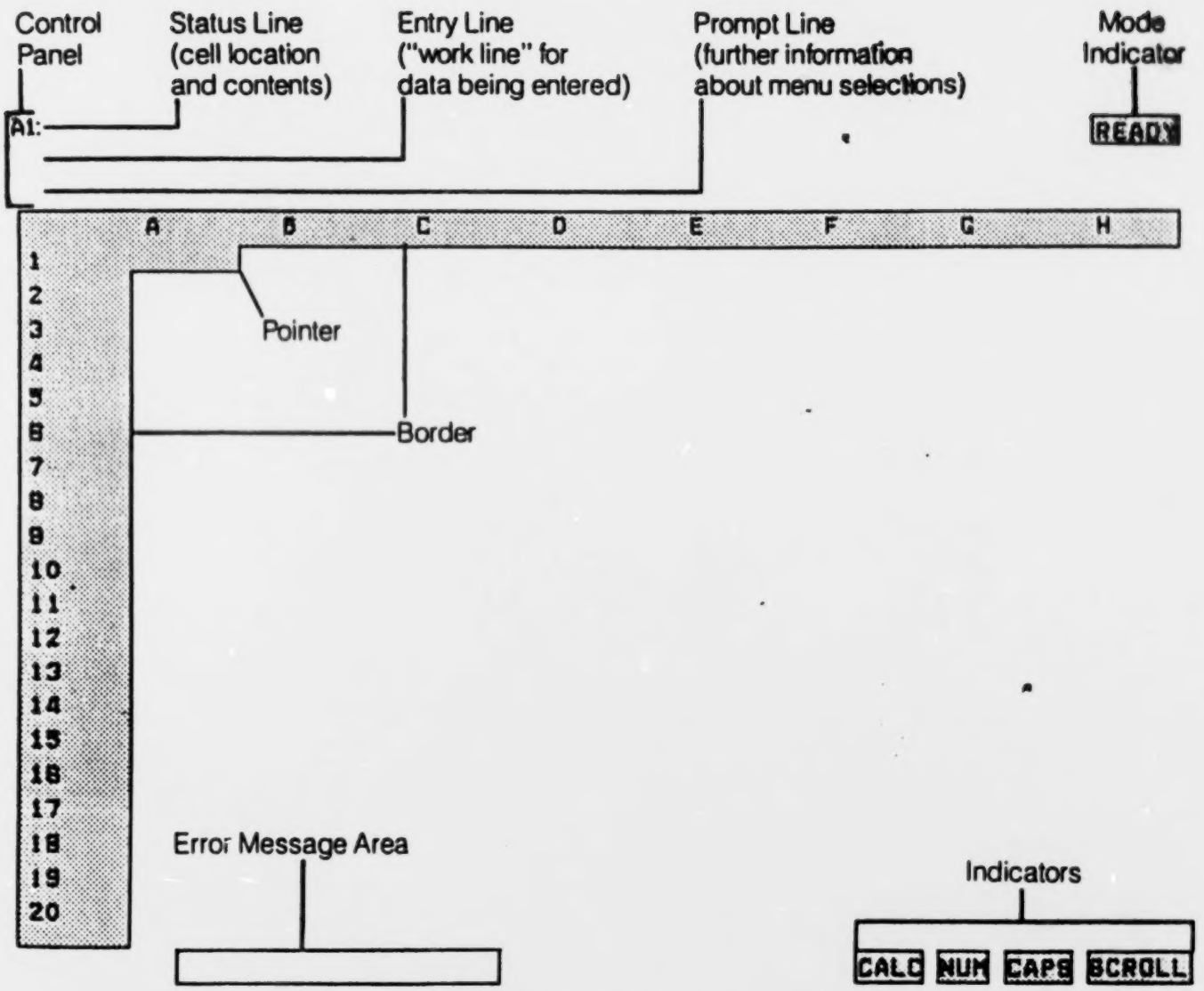
* **CONTROL PANEL** is the area above the reverse video border. It has three lines, each with a special purpose. The first line reveals the cell address, display format and actual contents of the cell. The second line displays the characters being entered or edited. The third line contains the menu items. [SHOW related transparency]

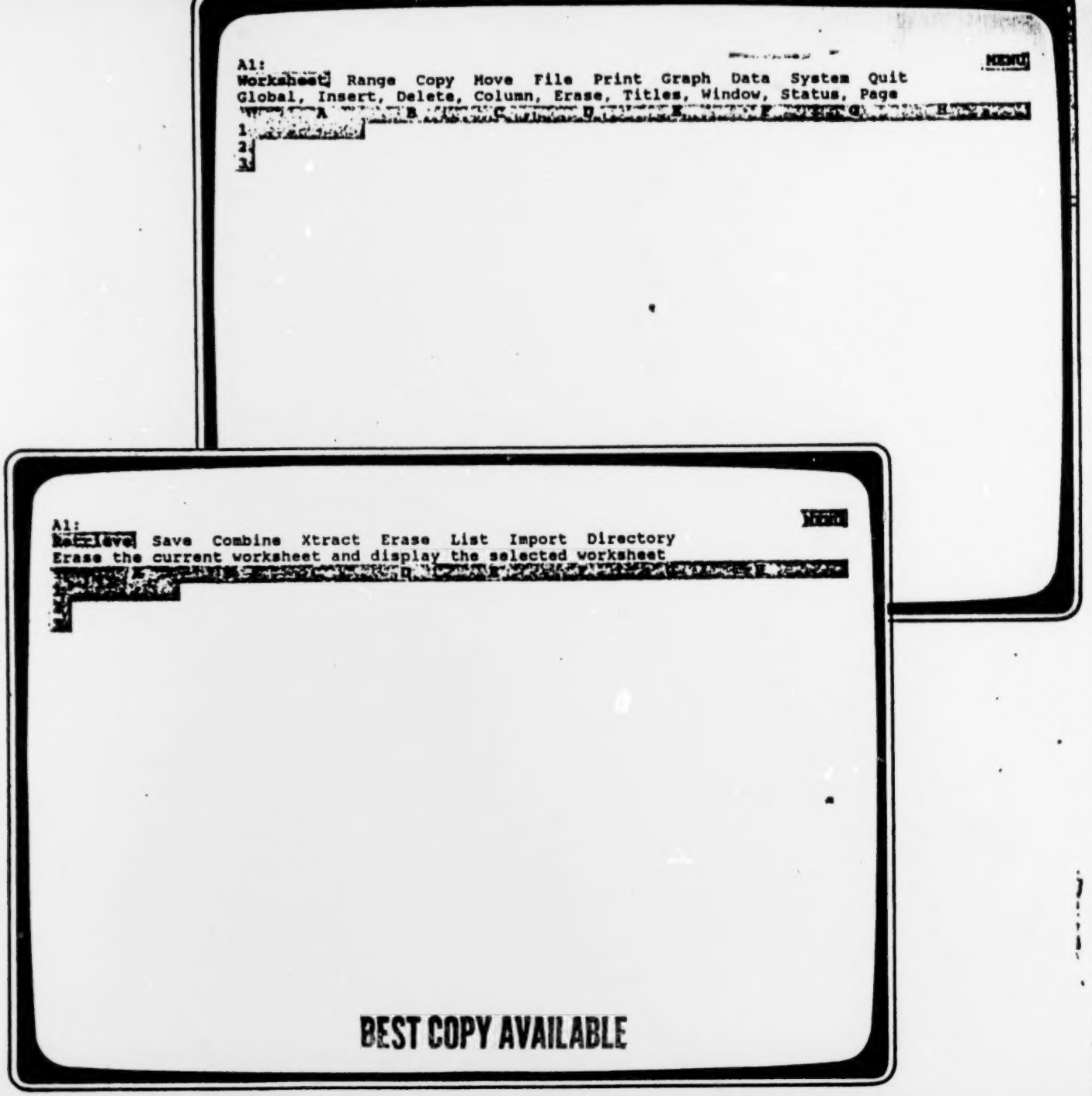
* **1-2-3 MENU COMMANDS** The cardinal command features of 1-2-3 arise above the spreadsheet on the primary menu board with a slash [/] keystroke. [SHOW the related transparency]

* **OPTION MENUS** (i.e., submenus or options below a main menu command appear on a secondary menu board) **/fr** keystrokes will take you to the main and secondary menu boards for file retrieval.

* **SCREEN CELLS** contain what appears on the screen

* **FILE CELLS** hold info behind the screen for particular cell. For instance, a certain cell may contain a formula. The control panel reveals the formula on file while the screen displays the result of the operation.


Control Panel
Status Line (cell location and contents)
Entry Line ("work line" for data being entered)
Prompt Line (further information about menu selections)
Mode Indicator
A1:
READY
A B C D E F G H
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Pointer
Border
Error Message Area
Indicators
CALC NUM CAPS SCROLL


A1:
MENU
Worksheet Range Copy Move File Print Graph Data System Quit
Global, Insert, Delete, Column, Erase, Titles, Window, Status, Page
A B C D E F G H
1
2
3
A1:
MENU
Retrieve Save Combine Xtract Erase List Import Directory
Erase the current worksheet and display the selected worksheet

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VITAL KEYSTROKING

* INVOKING 1-2-3

>cd\123 then 123; or >123

* ENTERING LABELS [']

LOTUS processes labels & numbers differently. Numbers can be used in arithemetic caluclations. Labels may NOT! Labels are traditionally aligned LEFT to RIGHT in a cell. Whereas, numbers are aligned along the RIGHT side. Labels can span several cells. Separate numbers are confined to individual cells unless made into a label with a single quote ['] preceeding the number. HINT: Readability is very important in all computer applications. Placing a title next to any number or calculation is a good habit to adopt.

* ARITHMETIC FORMULAS [+]

Addition, subtraction, multiplication, and division are 4 arithmetic operations frequently used in spreadsheet formulas. When used in LOTUS, however, these operations are NOT represented by standard symbols found in high school math texts. Instead, 1-2-3 incorporates symbols common to computer programming. [+ for additon], [- to subtract], [* for multiplication], [/ for division], [^ to exponentiate], [() for ()]. When building long formulas, the order of operations is important, too. LOTUS reads left to right using the PEMDAS {Please Excuse My Dear Aunt Sally} order of operations.

* MATHEMATICAL FUNCTIONS [@]

1-2-3 has over 100 functions in its library. These functions faclitate buidling spreadsheets. They convert several tedious arithmetic operations into a few simple keystrokes (e.g., SUM adds a very long string of numbers). Data analysis functions include: MAX, MIN, AVG & STD. Financial analysis can be done with NPV, etc. Today's DATE and time is available. Conditional functions like IF, AND, OR and NOT simplify long arithmetic formulas.

* RELATIVE & ABSOLUTE REFERENCING {$}

Cell coordinates are sometimes referenced to a cell's address. If cells are being copied down a column, the rows change for the relative address and vice versa. ABSOLUTE addresses do NOT change when copied. For instance, a formula may use a specific cell that cannot change when referenced.
(Not used in this presentation or my spreadsheet files.)

KEYBOARD COMMANDS

(SHOW RELATED TRANSPARENCY OF PC KEYBOARD)

/ (SLASH) invokes the main menu board

ESC (ESCAPE) gets you out of trouble & lower menus

<---' (ENTER) stores commands and editing

HOME takes you to cell A1

END takes you to the end of the spreadsheet

DEL (DELETE)

<-- (BACKSPACE)

SHIFT similar to CAPS mode on typewriter
SHIFT BACKSLASH [\] --> |
SHIFT* or SHIFT- or SHIFT= fills cell with **/--/==

TAB moves cursor to next cell or command

CTRL the control key for special functions

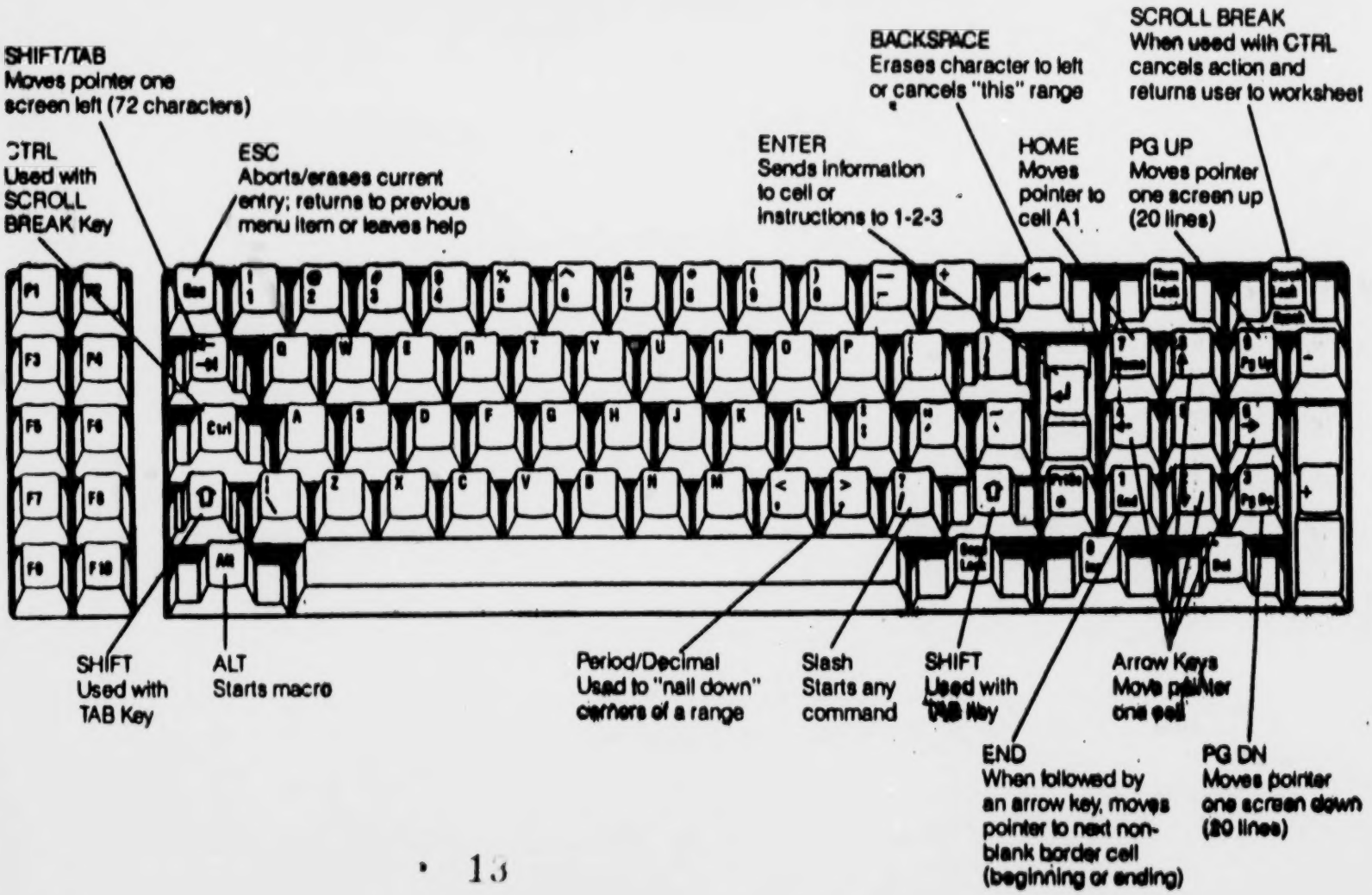
ALT the alternate key used on certain occasions

PRTSC will quickly print what appears on the screen

SCROLL ARROWS & PAGE SCROLLS

TOGGLES [alt] [F4]-->UNDO; [end] [v]-->BOTTOM OF DATA

FUNCTION KEYS (F1-F12) do special functions like edit [F2], go to [F5] and quick graph [F10] thus eliminating several strokes.


SHIFT/TAB
Moves pointer one screen left (72 characters)
CTRL
Used with SCROLL BREAK Key
ESC
Aborts/erases current entry; returns to previous menu item or leaves help
ENTER
Sends information to cell or instructions to 1-2-3
BACKSPACE
Erases character to left or cancels "this" range
HOME
Moves pointer to cell A1
PG UP
Moves pointer one screen up (20 lines)
SCROLL BREAK
When used with CTRL cancels action and returns user to worksheet
SHIFT
Used with TAB Key
ALT
Starts macro
Period/Decimal
Used to "nail down" corners of a range
Slash
Starts any command
SHIFT
Used with TAB key
Arrow Keys
Move pointer one cell
END
When followed by an arrow key, moves pointer to next non-blank border cell (beginning or ending)
PG DN
Moves pointer one screen down (20 lines)

MICROECONOMIC SPREADSHEET

We will examine the Pure Competition microeconomic model first today. A copy appears on the next page. It is stored on the diskette and a copy of the related homework assignment is available in your jacket pocket. The keystrokes needed to place this model or spreadsheet into the main memory of the computer and on the monitor for analysis and change follow:

/ (SLASH)

F (FILE)

R (RETRIEVE)

PURE COMP (NAME OF FILE)

<--' (ENTER)

(Show related transparency of spreadsheet)

MICROECONOMIC SPREADSHEET

COST/REVENUE ANALYSIS

Quantity of Output (units per day)	Quantity of Labor (lbr hrs per day)	Added Labor Hours per Added Unit of Output	Added Units of Output per Added Labor Hour (margnl phys product of labor)	Total Variable Cost	Total Fixed Cost	Total Cost	Marginal Cost (dollars per unit)	Average Variable Cost (dollars per unit)	Average Fixed Cost (dollars per unit)	Average Total Cost (dollars per unit)	Sales Price	Sales Quantity	Total Revenue	Marginal Revenue	Total Profit	Average Revenue
0.00	0.00			$0.00	$2,000.00	$2,000.00					$2,400.00	0.00	$0.00		($2,000.00)	
1.00	30.00	30.00	0.026	$300.00	$2,000.00	$2,300.00	$300.00	$300.00	$2,000.00	$2,300.00	$2,737.00	1.00	$2,737.00	$2,737.00	$357.00	$2,737.00
2.00	72.00	34.00	0.029	$720.00	$2,000.00	$2,720.00	$310.00	$360.00	$1,000.00	$1,360.00	$2,932.00	2.00	$5,984.00	$3,247.00	$3,264.00	$2,992.00
3.00	102.50	30.50	0.033	$1,025.00	$2,000.00	$3,025.00	$305.00	$341.67	$666.67	$1,008.33	$3,126.00	3.00	$9,578.00	$3,594.00	$6,583.00	$3,126.00
4.00	130.00	27.50	0.036	$1,300.00	$2,000.00	$3,300.00	$275.00	$325.00	$500.00	$825.00	$3,380.00	4.00	$13,280.00	$3,671.00	$9,980.00	$3,380.00
5.00	155.00	25.00	0.040	$1,550.00	$2,000.00	$3,550.00	$250.00	$310.00	$400.00	$710.00	$3,372.50	5.00	$16,862.50	$3,582.50	$13,312.50	$3,372.50
6.00	178.00	23.00	0.043	$1,780.00	$2,000.00	$3,780.00	$230.00	$296.67	$333.33	$630.00	$3,482.00	6.00	$20,892.00	$4,029.50	$16,632.00	$3,482.00
7.00	199.50	21.50	0.047	$1,995.00	$2,000.00	$3,995.00	$215.00	$285.00	$285.71	$570.71	$3,335.57	7.00	$23,349.00	$3,358.00	$19,354.00	$3,335.57
8.00	220.00	20.50	0.049	$2,200.00	$2,000.00	$4,200.00	$205.00	$275.00	$250.00	$525.00	$3,360.00	8.00	$26,880.00	$3,189.00	$22,680.00	$3,360.00
9.00	240.00	20.00	0.050	$2,400.00	$2,000.00	$4,400.00	$200.00	$266.67	$222.22	$488.89	$3,220.00	9.00	$28,980.00	$2,820.00	$24,580.00	$3,220.00
10.00	260.00	20.00	0.050	$2,600.00	$2,000.00	$4,600.00	$200.00	$260.00	$200.00	$460.00	$3,220.00	10.00	$32,200.00	$3,220.00	$27,600.00	$3,220.00
11.00	282.00	22.00	0.045	$2,820.00	$2,000.00	$4,820.00	$220.00	$256.36	$181.82	$438.18	$3,133.00	11.00	$34,463.00	$2,263.00	$29,643.00	$3,133.00
12.00	305.00	23.00	0.043	$3,050.00	$2,000.00	$5,050.00	$230.00	$254.17	$166.67	$420.83	$3,038.00	12.00	$36,456.00	$1,993.00	$31,406.00	$3,038.00
13.00	330.00	25.00	0.040	$3,300.00	$2,000.00	$5,300.00	$250.00	$253.85	$153.85	$407.69	$2,915.00	13.00	$37,895.00	$1,439.00	$31,595.00	$2,915.00
14.00	357.50	27.50	0.036	$3,575.00	$2,000.00	$5,575.00	$275.00	$255.36	$142.86	$398.21	$2,787.50	14.00	$39,025.00	$1,130.00	$33,025.00	$2,787.50
15.00	388.00	30.50	0.033	$3,875.00	$2,000.00	$5,875.00	$305.00	$258.33	$133.33	$391.67	$2,646.00	15.00	$39,690.00	$665.00	$33,815.00	$2,646.00
16.00	422.00	34.00	0.029	$4,220.00	$2,000.00	$6,220.00	$340.00	$263.75	$125.00	$388.75	$2,488.00	16.00	$39,808.00	$118.00	$33,588.00	$2,488.00
17.00	460.00	38.00	0.026	$4,600.00	$2,000.00	$6,600.00	$380.00	$270.59	$117.65	$388.24	$2,310.00	17.00	$39,270.00	($538.00)	$32,670.00	$2,310.00
18.00	502.50	42.50	0.024	$5,025.00	$2,000.00	$7,025.00	$425.00	$279.17	$111.11	$390.28	$2,107.50	18.00	$37,935.00	($1,335.00)	$30,910.00	$2,107.50
19.00	550.00	47.50	0.021	$5,500.00	$2,000.00	$7,500.00	$475.00	$289.47	$105.26	$394.74	$1,873.00	19.00	$35,587.00	($2,348.00)	$28,125.00	$1,873.00
20.00	603.00	53.00	0.019	$6,030.00	$2,000.00	$8,030.00	$530.00	$301.50	$100.00	$401.50	$1,686.00	20.00	$33,720.00	($1,867.00)	$25,690.00	$1,686.00
21.00	662.00	59.00	0.017	$6,630.00	$2,000.00	$8,630.00	$590.00	$315.71	$95.24	$410.48	$1,493.00	21.00	$31,353.00	($2,367.00)	$23,323.00	$1,493.00
22.00	727.50	65.50	0.015	$7,275.00	$2,000.00	$9,275.00	$655.00	$330.68	$90.91	$421.59	$1,327.50	22.00	$29,205.00	($2,148.00)	$21,205.00	$1,327.50
23.00	800.00	72.50	0.014	$8,000.00	$2,000.00	$10,000.00	$725.00	$347.83	$86.96	$434.78	$1,200.00	23.00	$27,600.00	($1,605.00)	$17,600.00	$1,200.00
24.00	880.00	80.00	0.013	$8,800.00	$2,000.00	$10,800.00	$800.00	$366.67	$83.33	$450.00	($0.00)	24.00	($0.00)	($27,600.00)	($19,600.00)	($0.00)

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USING GRAPHS

Assembling large amounts of data into a spreadsheet format facilitates analysis and understanding. It can still be difficult to detect the significance of a change in the data in a tabular format. Graphs make it easier to detect trends and see relationships between various numbers (Napier & Judd, 1988). Louts 1-2-3 can draw several different types of graphs for quick analysis of the data. The type of graph desired depends on the type of relationship that exists between the data examined. The type of graph desired is found in the subcommand menu: /(slash) G (graph) T (type of graph). Five types are found using this submenu:

* LINE (SCALING THE GRID)

* BAR (SHADY COMPARISONS)

* PIE (PORTIONS OF ONE TOTAL)

* STACKED BAR (PORTIONS OF SEVERAL)

* XY (ANALYSIS OF CHANGE/DIFFERENT SCALES)

PURE COMPETITION GRAPH

{needed keystrokes from Pure Comp file; available as assignment in jacket pocket}

/ {brings up command menu & submenu}

G {invokes the GRAPH command}

T or (ENTER) {invokes the TYPE OF GRAPH submenu}

L or (ENTER) {tell 1-2-3 you want a line graph}

X (ENTER)

A17.A35 (ENTER)

A (ENTER)

H17.H35 (ENTER)

B (ENTER)

I17.I35 (ENTER)

C (ENTER)

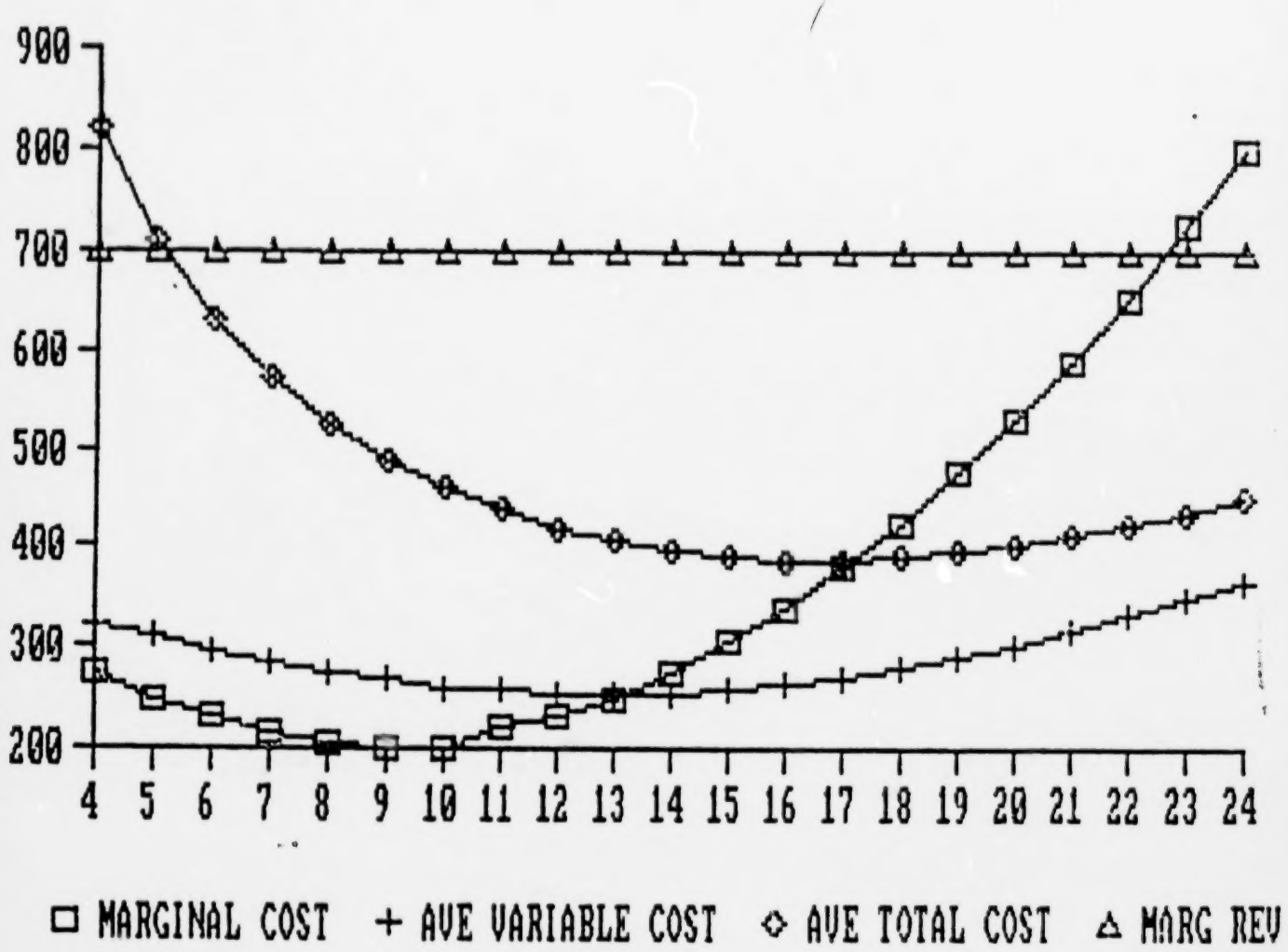
K17.K35 (ENTER)

D (ENTER)

O17.035 (ENTER)

V{iew} (ENTER) PRTSC {print screen} ESC {escape}

MICROECONOMIC GRAPH



OTHER GRAPHS

ON YOUR1-2-3 DISK

The following files, named with underlining below, represent economic models presented in all elementary microeconomic texts. I use them in conjunction with a homework assignment for my students. The files are on the furnished diskette. The MONOPOLY assignment, together with the PURE COMP assignment, is also available in the back pocket of your packet.

MONOPOLY

/FRMONOPOLY (ENTER)
/G F10
{to see concomitant graph}

SUPPLYCURVE

/FRSPLYCRV (ENTER)
/G F10
{to see concomitant graph}

PIE CHART

/FRSALES (ENTER)
/G F10
{file available to show concomitant graph}

(F10=QUICK GRAPH)
DISPLAYS A PREDRAWN GRAPH SAVED UNDER THE FILE NAME

SENSITIVITY ANALYSIS

(WHAT IF A DATA CHANGE IS MADE? WHAT HAPPENS TO THE REST OF THE SPREADSHEET DATA?)

* WORKSHEET WHAT-IF QUESTIONING

  Use SPLYCRV (i.e., /FRSPLYCRV file and homework) in order to determine what happens to all of the cost curves when you give the employees a pay raise from $10 to $15 per hour. The commands for this change involve a simple entry of 15 in the first cell of the Total Variable Cost column and a copy command sequence to the end of the column. That is: F5 (go to) E11 15 ENTER /c ENTER .. ALT END or PGDN or down arrow to E35 ENTER.

* WINDOWING divides the screen into two windows that display different parts of the same workesheet. This capability is helpful to show one column or row of data next to another not available because the data needed is off the screen (e.g., titles). It can be done by the Window or Title command. TheWindow command (/W) is more versatile because you do not just deal with titles.

* GRAPHIC ANALYSIS helps you find the MR=MC intersection on the graph instead of among the long spreadsheet. It is helpful to make other significant points quicker using a graphic picture of the data.

* SIDE-BY-SIDE GRAPHS using the ALLWAYS add-on program allows you to view changes to the graph as you make changes to the data while playing What-If; the instant Ah-ha! This does not just instruct; it inspires.

OTHER OPTIONS

* AESTHETICS You can label your graphs using the axis label command. Scruffy appearances can be exhibited in a more appealing manner by changing display formats and print fonts for numbers and alpha characters.

* PRINTING with the PrintGraph option instead of PrtSc key permits you to store the graph under a file name for printing later. ALLWAYS allows you to view or print two[2]+ items (e.g., table & graph) side-by-side.

* WYSIWYG What you see is what you get equips you with desktop publishing capability. You actually see the final format of the graph, spreadsheet, and/or report.

* MACROS These are keyword commands that furnish you with many of the features of sophisicated programming languages. These commands allow macros to perform a wide range of functions: simulation modeling (Godin & Rao, 1988), querying the user, creating menus, and, most importantly, controlling the execution of the macro itself.

* PROTECTION prevents certain entries from being altered. You can protect a spreadsheet in three [3] different ways: hidden cells, cell protection, and passwords

* DATA (FILL/DISTRIBUTION/TABLE/REGRESSION)
Several submenu commands allow you to manipulate data in cells for special reasons.

* DATABASE & OTHER APPLICATIONS
Data management can occur in another form besides the DATA command in the main menu. Lotus Development Corporation built 1-2-3 to handle a data base within the spreadsheet. Thus, the data base resides in RAM which speeds the processing time required to manipulate cells and groups of cells. You can also use 3-D spreadsheets to consolidate information from a detail spreadsheet into a summary spreadsheet rapidly (Napier & Judd, 1988).

SYSTEM CONFIGURATION

* KEYBOARD QWERTY with numeric pad & toggles & F1-F10
(Related transparency is shown above)

* PRINTER graphics printer capability

* MONITOR VGA, EGA, high resolution CGA

* DISK DRIVES 2 floppy drives w/384K of RAM; 1 floppy & 5MB hard drive

* OPERATING SYSTEM DOS 2.1 or higher

* MICROPROCESSOR IBM PC PS/2 or compatible

* MATH COPROCESSOR supercharges the microprocessor.

* RANDOM ACCESS MEMORY 384K RAM/512K for WYSIWYG

* GRAPHICS ADAPTOR CARD Hercules adapter

THE PAST

During this presentation, we covered the following topics:

1. THE MICROCOMPUTER SPREADSHEET PACKAGE.

2. THE SPREADSHEET ANATOMY.

3. VITAL KEYSTROKING.

4. KEYBOARD COMMANDS.

5. MICROECONOMIC SPREADSHEET.

6. USING GRAPHS.

7. MICROECONOMIC GRAPHICS.

8. SENSITIVITY ANALYSIS.

9. OTHER OPTIONS.

10. SYSTEM CONFIGURATION.

THE FUTURE CLASSROOM/OFFICE?

We live in the era of the technocrat. Businesses, government agencies, educational institutions and other organizations use computers and related technologies to handle tedious paperwork, provide quality service to customers, generate clearer answers and provoke more challenging thought for students, reduce waste in industry, produce sufficient inventory quantities just in time to meet demand anywhere in the world, and assist managers in making very long-range plans and much better decisions.

The ability to utilize computer graphics in many forms of educational communication, from oral presentations to written reports, is being recognized as a crucial skill. Increased atttention has been focused lately on ways to effectively express copious amounts of data effectively through computer graphics (Bertelson & Klemin, 1988). Simulation modeling of several different graphs using macros from Lotus 1-2-3 is an educational application espoused by Godin & Rao (1988). The University Honors Program at University of Michigan uses the Lotus 1-2-3 spreadsheet, database, and graphics in the Accounting Principles course (Keros & Kruse, 1991).

The computer pervades every activity on campus and elsewhere. Lotus 1-2-3 and other similar spreadsheet packages with graphics packages (e.g., Microsoft EXCEL) have become a de facto standard in the classroom and industry. This ubiquitous technology is therefore essential to know and use (Patton, 1990).

Whether an instructor integrates graphics into a course or not depends upon their own personal learning beliefs. Personal practical theories play a significant role in making curricular decisions about classroom instruction (Cornett, 1990). However, the learning potential of graphics and other computer technology cannot be discounted (Bozeman & House, 1988).

This presentation attempted to illustrate how instructors can use Lotus 1-2-3 graphics in microeconomics to create wonderful pictures to make a point or get students through the Ah-ha syndrome. The essence of an integrated software package like Lotus 1-2-3 lies in its ability to evaluate the effects of changes in variables almost as fast as you can enter the changes (Ciolfi, 1990). It is hoped that many more courses will be undertaken that teach valuable graphic skills necessary for effective communication.

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